INSTRUCTION SHEET 3-1

UNIT 3: VISUAL FIXING

INTRODUCTION

Because of the task saturation that accompanies low altitude flight, determining how to maintain course navigation through the low level is an important part of mission planning. In the T-34 and T-1, visual fixing is your primary means of low altitude navigation. The focus of this unit is the techniques and procedures we use to determine the best features for intermediate check points and turnpoints.

ENABLING OBJECTIVES:

2-4. Given a specified course, identify visual low-level course intermediate checkpoints and turnpoints to an accuracy of 50% for intermediate checkpoints and 80% for turnpoints.

5-1 Prepare a visual low-level navigation chart, given a specified course and a Tactical Pilotage Chart (TPC), Fuel $\pm$ 40 lbs. T-34; time $\pm$ 36 sec T-34, course $\pm$ 2º; plotting without error.

ENABLING STEPS:

2-3-1 State the characteristics that make a feature desirable as an intermediate check point or turn point.

2-3-2 State the mission related factors that influence choice of visual check points and turn points.

2-3-3 Derive information from visual fix points regarding time and course position.

5-1-17 Given a properly constructed low level chart, choose and annotate features for use as intermediate check points.

5-1-18 Prepare a pilot card listing turn point and intermediate check point data.

INFORMATION SHEET 3-1

Characteristics of Good Check Points

One of the most important qualities of a check point is that we be able to see it! There are several factors that determine the quality of a visual check point. Size is important as a larger feature can generally be seen from greater distances and is easier to identify.

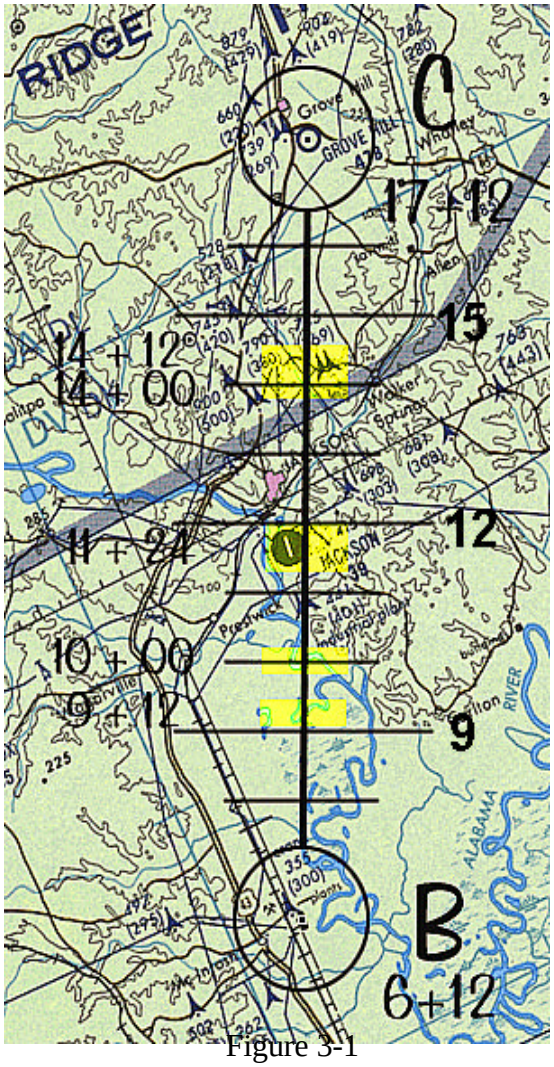


Figure 3-1

Horizontal development refers to the "width" of the feature. Coast lines, lakes, roads, and rivers are examples of feature with large horizontal development.

Vertical development refers to height, towers, mountains and other man-made structures.

The ideal check point has both vertical and horizontal development. Such a point might be a tall bridge across a wide river or a large factory complex with tall smoke stacks (Figure 3-1, point "B"). Unfortunately, such points are not always available.

For *T-34 flights, horizontal development is more desirable* than vertical development due to the altitude (1200-1500' AGL) flown (Figure 3-2, river trends at 9+12 and 10+00).

In lower altitude flight (500'AGL), vertical development will prove more effective as horizontally developed features become masked by trees and a shortened horizon (Figure 3-1, towers at 14+12).

When choosing features to serve as check points, remember that the goal is to fix your position as accurately as possible. While the airfield is a good example of horizontal development, it may not provide the most accurate position unless a distinctive structure or runway is used (figure 3-1, airfield at 11+24).

INFORMATION SHEET 3-2

Likewise, a road crossing our planned track at 45 degrees does not give us good track or time information unless there is a distinctive bridge or intersection to mark a specific point along that road.

Some additional features to remember when selecting check points:

- Inferred bridges crossing double lined rivers are a minimum of 600 feet in length.
- Where primary roads cross interstate highways, an over pass or bridge is generally present.
- Multiple tower annotations can represent two, three or even twenty towers, making accurate position fixing difficult.
- Look for other features that identify the check point, such as terrain, river bends, roads, etc. In this manner, a small distinct check point can be verified as the correct point. In figure 3-2, note the road intersection prior to the bridge insures that we have the correct bridge.

Figure 3-2

INFORMATION SHEET 3-3

Mission Related Considerations for Choosing Check Points

While aspects of the actual turn point are critical, there are mission related factors that are also important. These include the altitude to be flown, visibility, mission pacing and aircraft type.

The altitudes flown in T-34 make horizontal development more desirable than vertical development. In a T-1 at 500 feet AGL, towers "rise" above the horizon, so the angle of view makes them easier to spot and identify.

Visibility is also related to altitude, as it affects the visible distance to the horizon. Typically, **do not choose check points more than 3 nm from planned course line**. Points greater than 3 nm are difficult to identify and judge position from. Ideally, choose points as close to course as possible.

Mission pacing requires an appropriate amount of distance between check points. Typically, this distance is never less than one minute, and ideally greater than three minutes to enable accurate wind analysis.

Because of turn point procedures performed on each low level leg, *avoid choosing intermediate check points two minutes prior to or one and a half minutes after a turn point.* Ideally, we choose at least one intermediate check point per leg. However, if the leg is short or if no prominent feature is available, that leg may not have an intermediate check point.

A final consideration is the information that an intermediate check point provides. Roads or rivers running parallel to your planned track give information regarding course, while roads and rivers running perpendicular to your track give information regarding time. Ideally, an intermediate check point should give both types of information, such as a tower or a bridge that indicates both course and time deviations.

Choosing and Annotating Intermediate Check Points

After selecting intermediate check points, annotate them on your chart by simply placing the time in minutes and seconds next to the point, but outside of the tick marks. Figure 3-1 shows check points properly annotated. Indicate intermediate check points in black ink with only the time annotation. Typically, you can expect to have approximately six to eight intermediate checkpoints annotated on a VT-4/VT-10 chart.

But what if you want more? In flight, it is important able to use planned as well as *unplanned* intermediate check points. Using the concept of **CLOCK, CHART, GROUND**, use any feature along your flight path to fix your position in flight. However, you are specifically graded on the annotated turn points.

INFORMATION SHEET 3-4

Deriving Information from Visual Fix Points

Intermediate turn points on a low level chart can only help us if we know how to find and use them. By keeping the chart oriented with the track of the aircraft, landmarks on the ground appear in the same relative position as the features on the chart.

But what will the feature look like? Geography, climate, altitude and season are just some of the factors affecting the appearance of check points. As your flight experience increases, so will your ability to predict how a particular feature will appear from the air. Below are some points to consider when searching for specific features:

- Roads running perpendicular to course may be masked by trees, look for traffic, particularly trucks.
- Rivers may be masked just as roads are. Look for changes in forest color. Typically, deciduous (leafy) trees will grow next to the rivers, while pines will grow everywhere else. Also look for the lower terrain associated with the river bed.
- Pay close attention to the contour lines on your chart. They may indicate terrain trends useful for navigation or terrain that may hide other check points.
- Observation towers (generally placed in forested areas) may only appear as a small building sitting on the tree line.
- Remember that a bridge is where "a river and road meet,"-- the river and road are likely to be visible long before the bridge.
- Underground pipelines may look similar to dirt roads, but generally they are unnaturally straight and have few turns.
- Lakes in low lying areas (marsh/swamp) can change shape with the tide or with heavy rains or drought.
- For your flights in the T-34 at 1500', one wing-tip distance is equal to about 1 nm on the ground.

Perhaps the most common reason students fail to see an intermediate check point is actually quite simple: *They are not looking in the right place at the right time*! Prevent this problem with an effective **CLOCK, CHART, GROUND** scan. This scan runs as follows:

- ***CLOCK***: Check current elapsed time, add approximately ½ to a full minute. Do not look for points that should already be behind you!
- ***CHART***: Apply time to chart to determine what features and terrain trends should be visible and at what time. Look for large features that can "point" to smaller features. For the bridge in figure 3-2, such features include the river and the road.
- ***GROUND***: Visually search for the features, taking into account time and track position. (e.g.: I am a little early and possibly left of course, so the check point should appear earlier and to the right…).

If you are doubtful of your position, look for related details before the checkpoint so it can be positively identified. Remember, the chart does not show all the details that are on the ground. For example, if you note that you are flying over a two-lane road, there is probably one

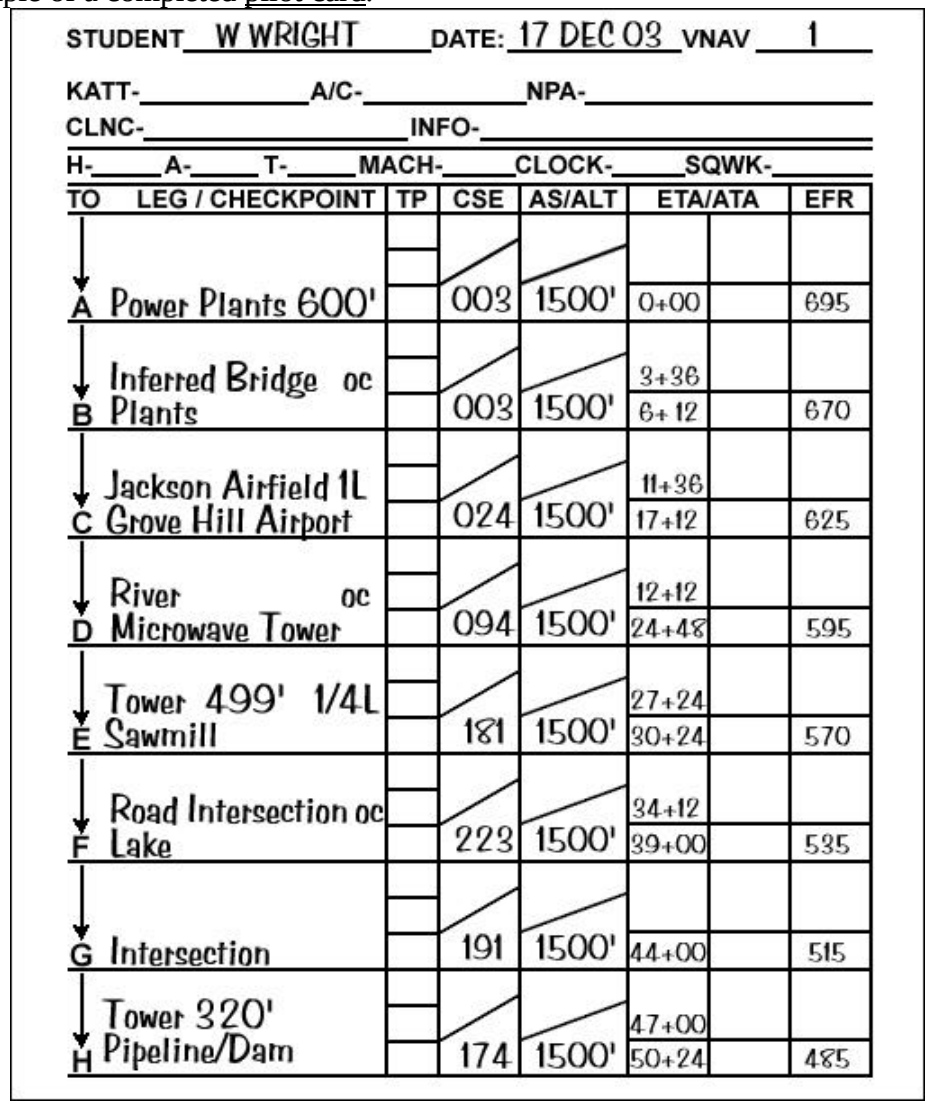
on your chart for that leg… but is it the right one? A common error made by students (and even some experienced aviators) is using ground features without reference to the clock. Remember, the clock verifies that the point on the ground is the same point annotated on your chart!

With an intermediate check point in sight, the next question is "What is it telling me?" Unfortunately, not all intermediate check points give the same information. Ideally, a point tells us if we are early or late, and if we are left or right of planned track. Such a point might be a specific bridge or a water tower located in a small town. However, if the check point is a road perpendicular to our track, it gives us only timing information; we compare our actual time of arrival to our updated ETA to determine how many seconds off of planned. Likewise, if the intermediate check point was a railroad running parallel to our track, we could easily determine our distance from planned track, but we would not know if we were early or late. A road that crosses our track diagonally gives us little if any information since being left or right also would affect our timing across the road.

INFORMATION SHEET 3-6

The Pilot Card

Except for fuels, your low level chart is nearly complete. For T-34 VNAV flights, you will provide your instructor with a pilot card that outlines the turnpoints, intermediate checkpoints, course lines, planned altitudes, estimated times of arrival and estimated fuels remaining. Figure 3-3 is an example of a completed pilot card.



STUDENT W WRIGHT DATE: 17 DEC 03 VNAV 1

KATT-_____ A/C-_____ NPA-_____

CLNC-_____ INFO-_____

H-_____ A-_____ T-_____ MACH-_____ CLOCK-_____ SQWK-_____

TO	LEG / CHECKPOINT	TP	CSE	AS/ALT	ETA/ATA		EFR
A	Power Plants 600'		003	1500'	0+00		695
	Inferred Bridge oc				3+36		
B	Plants		003	1500'	6+12		670
	Jackson Airfield 1L				11+36		
C	Grove Hill Airport		024	1500'	17+12		625
	River oc				12+12		
D	Microwave Tower		094	1500'	24+48		595
	Tower 499' 1/4L				27+24		
E	Sawmill		181	1500'	30+24		570
	Road Intersection oc				34+12		
F	Lake		223	1500'	39+00		535
G	Intersection		191	1500'	44+00		515
	Tower 320'				47+00		
H	Pipeline/Dam		174	1500'	50+24		485

Figure 3-3

The information on the Pilot Card comes directly from your chart. Fuels, discussed in INFORMATION SHEET 3-7

the next chapter, are also included on the jet card. Note that intermediate check points are listed above the destination point for that leg.

LESSON SUMMARY

As the name implies, visual navigation means navigation through the use of visual check points. Aircraft type, planned altitude, mission pacing, and terrain are just some of the factors that can affect the quality and choice of visual check points. Due to the task saturation of the low altitude environment, it is important to plan turn points and check points in advance. Annotate intermediate check points during mission planning to insure proper pacing.

In visual navigation, the use of a CLOCK, CHART, GROUND scan is critical to both find points and prevent the mis-identification of points. Additionally, use of other terrain and cultural features (roads, ridges, rivers) aids in acquisition and identification of check points.

Finally, the last step in planning your fix sequence is the completion of the pilot card. This card should match your chart data and be complete prior to the brief.

In the next unit, fuel computations and DD-175s are the focus, completing our VNAV mission planning.

ASSIGNMENT SHEET 3-1

1. A smoke stack is an example of _____development.

2. A coastline is an example of _____ development.

3. Checkpoints are used to _____ the position of the aircraft.

4. A road segment which is perpendicular to your course would provide_____ information.

5. Due to mission pacing, do not choose intermediate check points within _____ minutes prior or _____ minutes after a turn point.

6. The proper scan sequence for locating and identifying check points is:

_____ _____ _____

7. For T-34 VNAV check points, _____ development is preferable.

8. One wing-tip distance is approximately _____ when flying at 1500' AGL.

9. Roads hidden by vegetation may be spotted by searching for _____.

10. Each VNAV route should have approximately _____ check points annotated.